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| | | | |
|---|---|---|---|
| To (Name) | T. H. Monk | Date | October 8, 1975 |
| Division | | | |
| Location | Building K-902-8, #309 | Originating Dept. | Instrumentation and Quality Assurance Development |
| | | Answering letter date | |
| Copy to | Attached Distribution | Subject | $UF_6$ Outleakage Tests in K-33 |
| | | | K-GD-1342 |

The attached test procedure for conducting $UF_6$ outleakage tests in the wing bypass housing in K-902-5 confirms and enlarges upon the discussion held in the meeting on this subject on August 26, 1975. The need for these tests stems primarily from the significant air flow pattern changes in the bypass housings which result from the new building ventilation system. The air velocities in the cell bypass housing and the unit bypass housing will vary along the length of the housings. The range of the air velocities in the cell bypass housing in the K-33 plant will be from nearly zero to in excess of 700 feet per minute. The air velocities in the unit bypass housing will also range from nearly zero to in excess of 500 feet per minute. The wing bypass housing air velocities will be more constant and in the range of 500 to 600 feet per minute. The air velocities in the corresponding ducts in the Paducah plant are expected to range 30 to 40% greater than the values given above.

The tests are expected to furnish the critical design criteria for the location, mounting arrangement, and quantity of sensors needed for CIP/CUP operating conditions. The test plans have been discussed with the other Instrumentation Keyman Committee members. The data will be applicable to the design of the systems at both the Oak Ridge and the Paducah Plants, and to a limited extent to the Portsmouth plant.

While most of the details of the test program have been worked out, it would be advisable to hold another meeting a few days before actual testing will get underway to review any late changes or to clarify peripheral activities such as safety and health physics considerations.

This document has been approved for release to the public by
T.W. Kelley for R.S. Quinn 1/31/96
Technical Information Officer Date
Oak Ridge K-25 Site

Classification changed to UNCLASSIFIED
(Circle one and category)
per Joan Hoeta 1/31/96
DC or AUD signature (first review) Date
per Yvonne W. Kelley 1/31/96

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GRJ:mw

W. O. Gentry for G. R. Jamieson
G. R. Jamieson, Chairman
Keyman Committee, Instrumentation

H. F. Collins
Classifying Official
Instrumentation and Quality Assurance Development Department Superintendent
Title of position

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# $UF_6$ OUTLEAKAGE MONITORING TESTS

I. PURPOSE OF TESTS

A. To determine the characteristics of an outleakage of $UF_6$ in the bypass housings and to determine the optimum sensor configuration and location to detect $UF_6$ outleakage at the lowest practical level of detection. No previous tests have been conducted under the air flow conditions that will be present in the bypass housings with the new building ventilation system. The information gained from these tests will be used to define the design criteria for the number, location, and installation configuration for the sensors to monitor the bypass housings.

B. To investigate the use of sensors in the cell outlet duct as replacements for those in the roof of the cell housing. If comparable outleakage sensitivity can be attained at this location, the number of sensors per cell housing could be reduced as well as eliminating the attendant inconvenience of having them in the roof of the cell housing.

C. If warranted, investigate any problems associated with monitoring the block valve bellows. The problems associated with containment of material from a ruptured bellows and various measures of coping with it are under discussion by the operation personnel of the three sites.

D. If deemed warranted, investigate the relative value of a sensor located at the building ceiling above each cell housing. Installing a detector at this location has been suggested in some three-site Engineering and Operations meetings.

II. TEST FACILITIES

A. Location

1. For the duct tests, the wing bypass duct between cell 7 and cell 9 in unit 902-5 will be used. Estimates indicate that modifications to the existing convection air flow system in K-33 together with an existing fan in a duct connecting the cell bypass housing to the building vent stack can achieve velocities of up to approximately 600 feet per minute in the wing bypass housing. While the volumetric flow rates expected in the cell bypass housing and the unit bypass housing cannot be achieved, the anticipated velocities can be approached which in turn will provide much needed information on the distribution of release products and the effects of different air velocities on the various sensor installation schemes.
2. For tests in the cell connector duct, the existing duct between cell 9 and the wing bypass housing will be used.
3. Location of other tests is dependent upon the decision to conduct them and will be worked out at a later date.

B. Modification details of the existing bypass housing to achieve the higher velocities in the wing bypass to be used for the test work are being worked out by engineering and operations personnel.

C. Test Configuration

1. In the wing bypass housing, two arrays of ten detectors each will be installed. One array will be located approximately 10 feet from the junction of the wing bypass housing and the cell bypass housing. The other array will be located at approximately the mid-point of the wing bypass housing. The effective length of the wing bypass housing is approximately 120 feet. By installing two arrays of detectors at different locations, the number of $UF_6$ releases can be reduced to approximately one-half the number that would be required with only one array.
2. The types of sensor configurations scheduled for installation at each location are described in figure 1 and table 1. These configurations will be used at the start of the testing program. It is likely that the results obtained from the initial test work will indicate a need to shift or interchange some of the units to attain the optimum configurations for the different test conditions.
3. In addition to the sensors, twenty temperatures will be measured at locations considered significant.
4. In the cell connector duct tests, those units which have shown promise in the wing bypass tests will be used. A total of four units will probably be tried and they are likely to be two types of duct detectors, an elongated detector, and a scoop-type detector.
5. Test configuration at other locations are uncertain at this time and will be influenced by pending decisions.

D. Test Equipment

All of the detector configurations, the detector monitoring equipment, the $UF_6$ release equipment, the air velocity measuring equipment, and the temperature recording equipment will be furnished by the Instrumentation and Quality Assurance Development Department. Other equipment for ancillary measurements will be furnished by those organizations concerned.

## III. TEST PROCEDURES

A. Wing Bypass Housing

1. In the wing bypass housing, tests will be conducted at three air velocity levels, the maximum that can be attained, about one-half maximum, and a velocity between 80 to 100 feet per minute, but not necessarily in that order.
2. Four release points will be used. The first will be at a point furthest from the detector arrays and near the existing duct that connects the wing bypass housing to cell 9. It will be approximately 50 feet from the nearest array of detectors and about one hundred and ten feet from the array that is furthest away.

   The second point will be about thirty feet closer to the arrays, that is, about the midpoint between the end of the bypass housing and the first detector array. These release points will be located at about the center of the duct. The other two release points will be selected on the basis of test results from the first two. The releases will be fewer in number and will be

used to explore the sensitivity of the detectors to releases at different locations within the duct, probably near the top and the bottom of the duct.

3. Release rates will start at 5 grams per minute for not longer than fifteen minutes and if necessary, the rate will be increased until a significant number of sensors alarm. The maximum release rate considered at this time is 100 grams per minute for ten minutes.
4. Not more than two releases will be made in any one day. This is necessitated by the need to clear the duct of any airborne material and to reset the test equipment.
5. Tails assay material will be used. The total amount of material released is not expected to exceed twenty pounds of $UF_6$ over a two month period.
6. The data collected will include relative humidity, temperature, sensor condition at beginning of test, sensor condition at end of test, release rate, and duct air velocity before test starts.
7. Some bulb samples for laboratory analysis will be taken from the duct after the initial tests have established the release rates and velocities of interest.

B. Cell Connector Duct

1. Tests will be conducted at an air velocity near the range expected with the new ventilation system.
2. $UF_6$ releases will be made at a point inside the cell housing furthest from the connector duct.
3. Release rates will start at 5 grams per minute for not longer than 10 minutes. If results so dictate release rates will be increased to not more than 25 grams per minute for a period not to exceed ten minutes.
4. Data similar to that obtained in the wing bypass tests will be worked out at a later date.

C. Other Locations

1. Test configurations, release rates, and other details will be worked out at a later date.

IV. TEST SCHEDULE

The $UF_6$ release tests are planned to start early in October and extend over a two month period. The schedule is dependent to some extent on the availability of maintenance support and on pending decisions regarding the use of sensors at other locations.

V. ANCILLARY REQUIREMENTS

1. The necessary information, procedures, and specific testing schedule will be supplied to the Environmental Management Group to meet their reporting and auditing requirements.
2. Air sampling and other procedures will be followed as requested by the Health Physics Groups.
3. The recommendations of the Industrial Hygiene Group will be followed.
4. A review of the testing activities will be conducted with a representative of the Safety Department to establish any specific safety requirements.

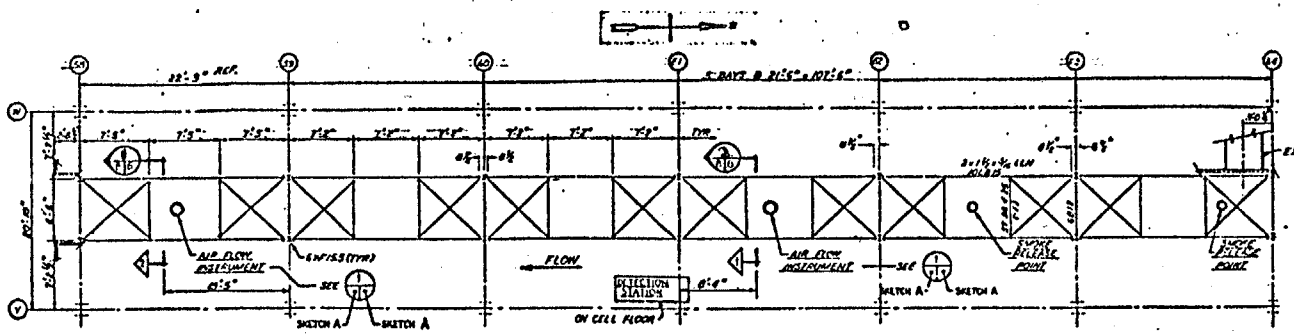
VI. COORDINATION OF ACTIVITIES

The following assignments for the coordination of the various activities associated with preparing for the tests, conducting the tests, and removal of the equipment after testing is complete are as follows. Some changes in the assignments may be made by the groups concerned as the project progresses.

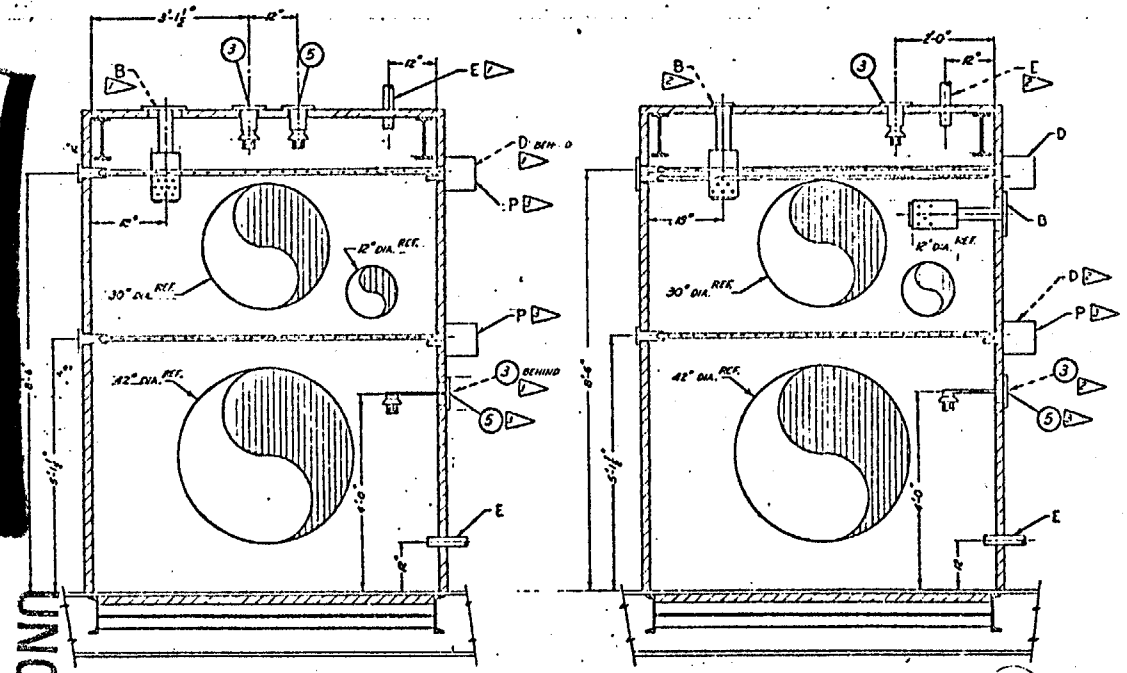
| | | |
|---|---|---|
| 1. | Test Planning | W. O. Gentry, Development<br>R. E. Cassell, Operations |
| 2. | Installation and Removal of Test Equipment | W. O. Gentry, Development<br>R. E. Cassell, Operations<br>M. C. Martin, Maintenance |
| 3. | Ventilation System Modifications | J. D. Worth, Engineering<br>R. E. Cassell, Operations |
| 4. | Test Scheduling | R. E. Cassell, Operations<br>W. O. Gentry, Development |
| 5. | Conduction of Tests | W. O. Gentry, Development<br>W. R. Cowden, Development<br>R. E. Cassell, Operations |
| 6. | Environmental Management Activities | M. J. Ellis |
| 7. | Health Physics Activities | J. C. Bailey |
| 8. | Industrial Hygiene Activities | H. F. Higdon |
| 9. | Safety Department Activities | T. B. Bomar |
| 10. | Correlation of Test Results | W. O. Gentry, Development<br>R. E. Cassell, Operations |

VII. CONTINGENCY CONSIDERATIONS

Because the above project constitutes a series of tests to optimize the criteria for the design of the outleakage detection system, minor revisions in the above program will almost certainly be made. Major revisions may be necessary in the event the test results do not approximate the needs of the CIP/CUP program in terms of sensitivity or quantity of sensors.




STEEL FRAMING PLAN- TOP ELEVATION TOP OF STEEL EL 81'7"
SCALE: 1/4"=1'-0"




SECTION 1 SKETCH B
LOCATION OF DETECTORS FOR MONITOR A
SCALE: 1"=1'-0"

SECTION 2 SKETCH B
LOCATION OF DETECTORS FOR MONITOR B
SCALE: 1"=1'-0"

NOTES:
1. DETECTORS 3 AND 5 THROUGH THE TOP OF THE DUCT AND 3 AND 5 (BEHIND TOP) THROUGH SIDE OF THE DUCT AT SECTION 1 WILL BE LOCATED APPROXIMATELY 2 FEET DOWNSTREAM FROM THE OTHER SIX DETECTORS OF THIS SECTION.
2. DETECTORS 3 AND 5 THROUGH TOP OF THE DUCT AND 3 AND 5 (BEHIND) THROUGH SIDE OF DUCT AT SECTION 2 WILL BE POSITIONED APPROXIMATELY 2 FEET DOWNSTREAM FROM THE OTHER SIX DETECTORS OF THIS SECTION.
3. CONTRACTOR WILL FABRICATE AND INSTALL MOUNTING BRACKETS FOR THE DETECTORS AS REQUIRED. THESE SHALL BE DESIGNED FOR EASY REMOVAL OF THE DETECTORS FOR SERVICING.
4. INSTALL 20 THERMOCOUPLES. SEE IDENTIFICATION TABLE BELOW.

SENSOR IDENTIFICATION:
- (1) Pyr-A-Larm F-5/A OPTICAL DETECTOR
- (5) Pyr-A-Larm F-52 CYLINDRICAL DETECTOR WITH Non ELECTRODE
- B GROUP 300 WITH ADJACENT AIR SCOOP. DETECTOR F-52 OR F-5/A
- D Pyr-A-Larm FIRE DUCT DETECTOR FIXED TYPE 33
- E FLEXIBLE PIPE FOR ELEVATED F-52 DETECTOR. REFLECTOR B-1-3004C
- P PCP ASPIRATED AIR DUCT DETECTOR TYPE 10DL. REFLECTOR C-1-3003C

DESCRIPTION OF THERMOCOUPLES

| PRINT | Location |
|---|---|
| 1 | Cell Floor Ambient. |
| 2 | Ambient Above Duct - Section 1. |
| 3 | Duct Temperature - Metal Contact at Section 1. |
| 4 | Air Temperature Through Duct at Top of Section 2. |
| 5 | Box B with Air Scoop - Through Top of Duct. |
| 6 | F-5/A Detector in PCP Aspirated Air Tube P Installed Near Top of Section 1. |
| 7 | F-52 Detector in Pyr-A-Larm Air Duct Detector B Installed Near Top of Section 1. |
| 8 | F-52 in Detector 5 Installed Through Side of Cell Housing at Section 1. |
| 9 | F-5/A Detector 3 Installed Through Side of Cell Housing at Section 1. |
| 10 | Elevated Detector Near Bottom of Section 1. |
| 11 | Air Through Top Section of Duct. Attach T. C. to Air Tube of Pyr-A-Larm B to Obtain Temperature Above Pipe at Section 2. |
| 12 | F-5/A 3 Through Top at Section 2. |
| 13 | Box with Air Scoop Through Side of Duct at Section 2. |
| 14 | Air Midway Between Two Large Pipes at Section 2. Attach T. C. to Pyr-A-Larm Air Tube to Take Air Temperature Between Large Pipes. |
| 15 | F-5/A Detector in PCP Box P at Section 2. |
| 16 | F-52 Detector in Pyr-A-Larm Box B Installed Midway Between Top and Bottom of Section 2. |
| 17 | F-52 Detector Through Side of Cell at Section 2. |
| 18 | Elevated Detector Through Side Near Bottom of Section 2. |
| 19 | Air at Top - Center of E-122-5.2. |
| 20 | Air Entering Vent Duct Exit from E-122-5.2. |

PRELIMINARY INFORMATION ONLY

Figure 1

SENSOR CONFIGURATIONS FOR TESTS IN AIR DUCTS

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EQUIPMENT LOCATION FOR AIR DUCT TESTS

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Table 1

SENSOR CONFIGURATIONS FOR TESTS IN AIR DUCTS

| Type of Sensor | Number | Symbol | Location |
|---|---|---|---|
| A. Sensors located near midpoint of the wing bypass housing (figure 1, section 2): | | | |
| F-5B or F-3/5A with ORGDP air scoop | 2 | B | One in top of housing and one in the side of housing about 2 feet below top. |
| Paducah-designed Pyr-A-Larm rake model | 1 | P | One in side of housing about midway between top and bottom. |
| Pyr-A-Larm Duct Detector (DIA-11) | 2 | D | One through side of housing near top and one at midpoint between top and bottom. |
| ORGDP Elongated F-5B | 2 | E | One in top of housing and one in side of housing near bottom. |
| Pyr-A-Larm F-3/5A standard detectors | 2 | (3) | One in top of housing and one through side about midway between top and bottom. |
| Pyr-A-Larm F-5B standard detector | 1 | (5) | One through side of housing about midway between top and bottom. |
| B. Sensors located adjacent to cell bypass housing (figure 1, section 1): | | | |
| F-5B or F-3/5A with ORGDP air scoop | 1 | B | One in top of housing. |
| Paducah-designed Pyr-A-Larm rake model | 2 | P | One in side of housing near top and one in side about midway between top and bottom. |
| Pyr-A-Larm Duct Detector (DIA-11) | 1 | D | One through side of housing near top. |
| ORGDP Elongated F-5B | 2 | E | One in top of housing and one in side of housing near bottom. |
| Pyr-A-Larm F-3/5A standard detectors | 2 | (3) | One in top of housing and one through side about midway between top and bottom. |
| Pyr-A-Larm F-5B standard detector | 2 | (5) | One in top of housing and one through side of housing about midway between top and bottom. |

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